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AUTHOR Cold, Birgit
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ABSTRACT

This paper describes how creation of a varied, imaginative, and cultivated environment can recreate the pleasure of learning. The development of an indoor-outdoor, public-private, and half-climatized glazed (glass covered) space at the University of Dragvoll in Trondheim, Norway, is described. Well-planned glazed spaces can increase social contact, serve various functions, provide stimulation, and be economically profitable. Considerations such as street design, daylight, view, acoustics, indoor climate, and plants are discussed. A quality glazed space should supplement urban space; include public, social, and commercial functions along the covered street; and contain communication areas near or within the glass-covered space. Four figures and seven drawings are included. (LMI)

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INDOOR RECREATIONAL PLACES AS GLAZED SPACE

Birgit Cold,Faculty of Architecture, Department of Architectural Design,
The University of Trondheim.

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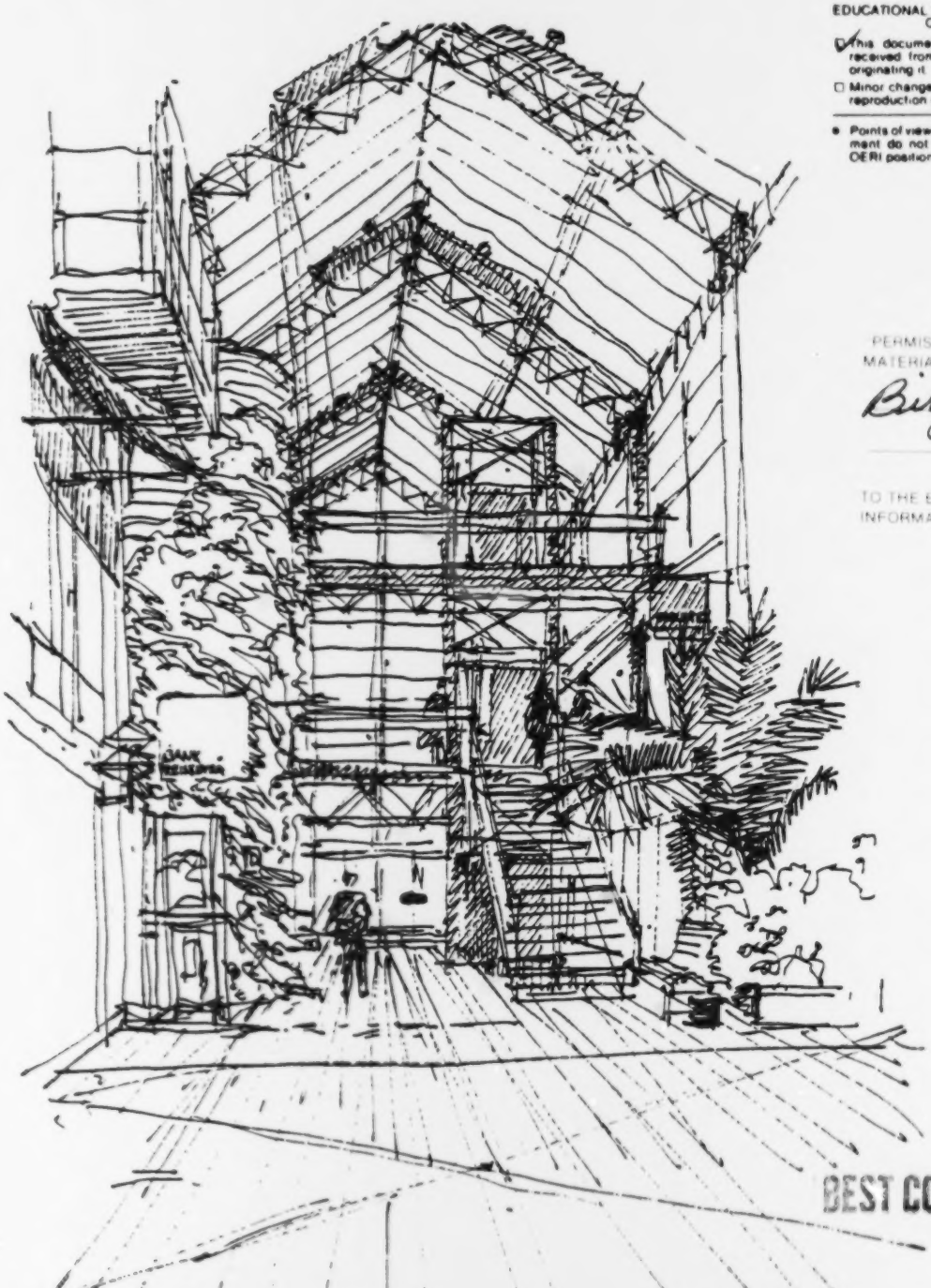

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Dragvoll Universitet, arch. H. Larsen. 28.2.89 Birgit Cold

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INTRODUCTION

Do you remember the dreary feeling, the heavy smelly air and the echoing sound of boots on a miserable cold day in the corridor of your childhood's school?

Do you also remember the thrilling feeling when trying to hide with a friend in the same wonderfully warm and 'cosy' corridor, when all the others were forced to go outdoor on a rainy and windy day?

Sitting, listening, working, trying to concentrate, understand and remember requires intervals to be able to RE - CREATE the engagement, the awarenes and the pleasure of learning.

How do we recreate during the long school day?

By variation, by DOING something different from what we were just doing, and by EXPERIENCING something different in the physical and social environment.
The' something different ' was in previous times the same as breathing fresh air compared with the exhausted ' breath ' of the classroom, running noisely around compared with sitting quietly, and socialising in joyful play compared with isolated classroom learning.

A large, open and paved schoolground was, and often still is, the main arena offered for recreation.

Green trees, red bushes, yellow flowers, hills, rocks, sand, grass and water, landscape to explore and sunny nooks, are qualities which are seldom found in the recreational school environment.
Recently, however, the outdoor and the indoor communication and recreation space are offered considerably more attention, recognising the importance of a varied, imaginative and cultivated environment.

In addition to an outdoor naturally 'wild' or 'beautifully cultivated' schoolground, it is of great quality ,especially in a cold, rainy and windy climate, or in an area with heavy traffic and polution , to glaze a space for recreation and social activities.

A glassroof allows daylight to penetrate the space and provide the adjacent rooms with sufficiant light. Green plants are willingly growing, and the protected common space becomes a social 'street', cool in the cold season, warm on sunny days.

This paper concentrates on the half indoor - half outdoor, half public- half private and half climatised glazed space, because it is well suited as recreational and social space in the school environment.

Such a glazed space were introduced in Trondheim at the University at Dragvoll, designed by professor Henning Larsen and his team at the beginning of the 1970's. During the 1980's Trondheim was enriched by several glazed spaces integrated in a hotel complex, in an extension of the Norwegian Institute of Techonology and in a large, cultural concert- and commercial building .

Research on glazed spaces has become of special interest to SINTEF (The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology) and to the Department of Architecture.
Experiences, especially those from the glass-covered street at Dragvoll, are here summarized and presented as a number of good advice.

GLAZED SPACE AND GLASS COVERED STREETS IN GENERAL

Glass covered streets, like those in Milan, Napoli, Leeds and London and glazed space, as we know them in covered markets, les Halles in Paris, exhibition halls like the Chrystal Palace and the palm houses we find in many capitals, are beautiful examples of early constructions in iron and glass.

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The daylight, the thin, delicate glass roof structures as protection from rain, snow and sunshine, create a perfect public space for people to meet other people, and to enjoy moving around looking at things and events.

The architects rediscovered the possibilities of gaining these qualities by integrating glazed spaces as part of the buildings.

Often, when we gain some qualities, we loose others. What about the indoor climate, the view, the noise, the quality of daylight, especially in the areas surrounding the glazed space? Do these glazed spaces cause problems for the users of the buildings? And what about the economic consequenses in investments and in use of energy ? Some experiences have been achieved concerning many of these problems.

This paper concentrates on the environmental and social qualities.

The University at Dragvoll in Trondheim is an example of a glass covered street, which has gained qualities without creating any serious problems.
As a result of the user evaluation carried out at the University, we may formulate three main qualities Glazed Space should generally have:

-they should increase the social contact
-they should be multifunctional
-they should be stimulating for the surrounding areas.

In addition to these functional, social and environmental qualities, they may be economically favourable by saving energy-, maintenance- and cleaning costs, if certain conditions are present.

EVALUATION OF THE GLASS-COVERED STREET AT DRAGVOLL, THE UNIVERSITY OF TRONDHEIM

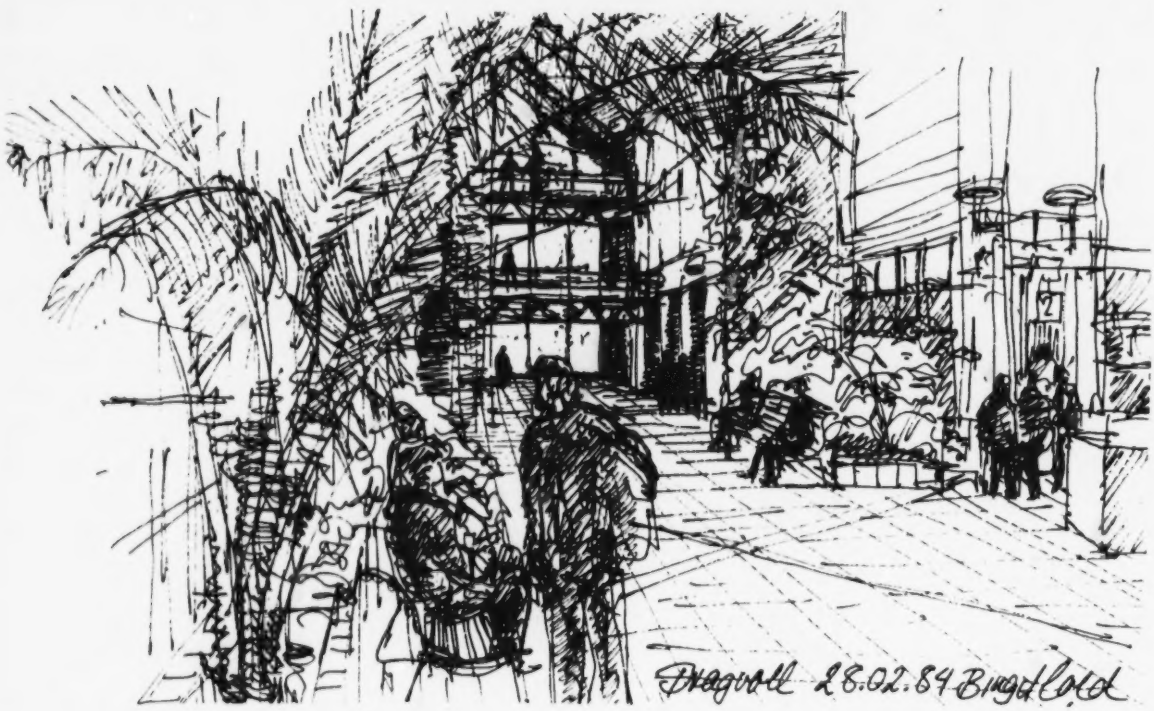
When the project at Dragvoll was initiated in the early 1970's, the concept of glass-covered streets and semi-climatized space were relatively unknown in Scandinavia.

The concept of the street at Dragvoll is partly based on the architects' experience of similar structures under quite different climatic conditions and partly on the idea of creating a lively street as the meeting place for all students and staff at the University. There were few experiences to gain from similar structures used in climate similar to Trondheim's.

In the 70's and the 80's the interest in glass covered space, streets and squares increased considerably. This has partly been based on notions of efficient energy use. The architects, on the other hand, have repeatedly emphasized the pleasant environment that may be achieved by using such structures. There has, however, been little documentation regarding the quality of working space adjacent to such streets, and also regarding the use of the street itself.

This investigation at Dragvoll University has clearly documented that glass covered and semi climatized space, used for circulation and social interaction, can provide positive qualities in the context of large educational buildings.

Independent of the technical and economical aspects of glass covered space, it is evident that one may achieve a series of pleasant environmental characteristics.



MAIN CONCLUSIONS

The following main conclusions are in general valid for building complexes built along the same principles as the Dragvoll street :

-glass covered and semi climatized space stimulate social life.

-common and public areas open to the glass covered space, generate greater activity in the space.

-glass covered space, as a common space, provides good oportunity for a variety of activities, both simultaneous and planned.

-it is completely feasible to attain fullworthy and attractive rooms for studying and office work, facing such glass covered space.

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-there are no technical problems linked to the providing of good daylight conditions in glass covered and semi climatized space.

-the local climate in this glazed space provides especially good conditions for an extensive and varied plant life.

Under advantageous conditions this type of construction may represent economic profit.

Such conditions may briefly be summerized as follows:

-glazed semi climatised space represents lower annual costs and good interest rates on further investments in the building complex.

-this space represents less use of energy and provides good economy for the maintenance of the building facades towards the space.

-this space reduces the need for cleaning, and considerable economic saving should be possible.

-this space provides saving of floorarea, when it is planned for multifunctional use.

THE STREET AT DRAGVOLL

We have examined the conditions in the street at Dragvoll through three independent investigations:

-a questionnairy investigation about the use and the experience from the street.

-a semantic description model regarding the users' evaluation.

-observations.

The questionnairy investigation primarily provides knowledge about the users' evaluation of the glass-covered street. The investigation provides information both about what really happens - for example, whether people stop and chat -, and, what the users feel about different aspects of the street such as the plants in the street, the quality of light, the view, the noise etc.

The semantic description model associates words, in the form of adjectives, with the street. This provides a surway of the statements.

Observations provide supplementary information about the use of the street. They present the number of people that are in the street at different times of the day, and what people do in the street.

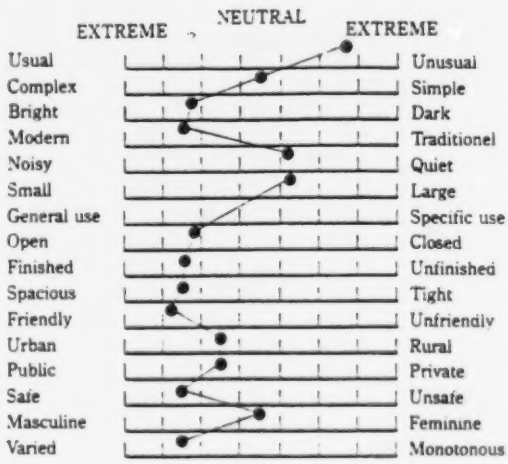
THE GLASS COVERED STREET AT THE UNIVERSITY AT DRAGVOLL

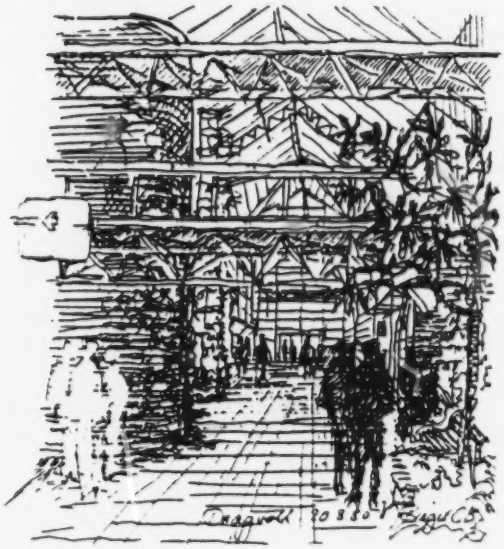
THE EVALUATION

The evaluation was undertaken during the autumn 1984. All employees and 25% of the students were questioned.

The results of the inquiry are representative of the users' opinion.

- More than 70% of the users responded to the questionnaire
- There is little variation in the answers
- There is to a large extent agreement between the students and the employees
- 30% of the employees who responded have their workspaces along the street





THE STREET AS A SOCIAL MEETING-PLACE

- The street is used by everybody, but most of all by students
- People stop and talk together regardless of weather and temperature
- People discuss their work as well as other subjects
- Special events are considered as stimulating
- The street is considered as extremely suitable for informal group meetings, plays, dance and music, exhibitions, meetings, and theatrical performances
- More than half of the people questioned feel that the street is an integral part of their work environment

THE STREET'S PHYSICAL ATTRIBUTES

- The daylight in the street is considered as very good and the noise level as below average
- The street is scaled so it is neither experienced as crowded, nor does it feel vacuous when few people are using it

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SOME GOOD ADVICE

The experiences we have gained the latest years, are here transformed into some good advice.

DAYLIGHT

The dimensions of the space between the buildings or walls, creating the glazed space, determine the conditions of daylight.

The construction and the type of glass also determine how much daylight is radiated. In unfavourable conditions, the daylight may be reduced with 50%, in the most favourable with 25%. It is important to choose construction and type of glass which reduce the daylight as little as possible.

The glassroof allows the indoor facades to have more glass, taking into account the loss of energy, compared with outdoor facades.

At Dragvoll University the glass area of the indoor facades is enlarged from the second to the ground floor.

Colours and materials of the indoor facades should be considered in relation to their ability to reflect the daylight. The deeper and more narrow the glass-covered space is, the brighter and more reflecting the surfaces should be.

Daylight radiated into rooms used for working, often means direct sunlight which soon becomes a heating problem.

Direct sunlight may either be prevented in each, single room by awnings or shades, or by screening the glass roof. The individual screening should be used if only a few rooms are bothered by overheating, and many rooms need as much daylight as possible. If the amount of daylight is no problem, screening of the glass roof may be considered.

VIEW AND INLOOK

The conditions of view from the windows and looking into other peoples rooms, are in principle the same with or without covering the space between the buildings with a glassroof. But a few things are different.

When the snow falls heavily, and the temperature is around 0oC, the glass roof may be covered with snow, which slowly slides down. The pitch should therefore be at least 30o and preferably 35o or more in order to make the snow slide more easily.

A CONSUMER EVALUATION CARRIED OUT BY

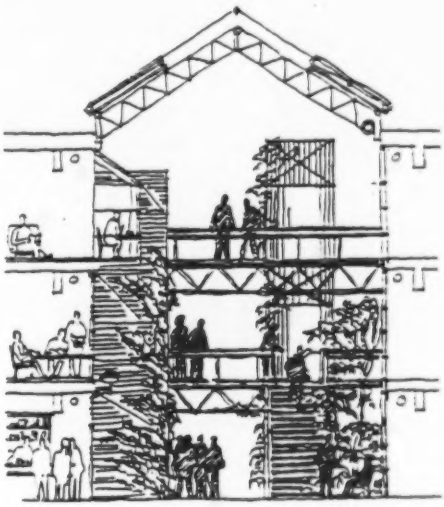
SINTEF – Division of Architecture and Building Technology, dr.ing. Sigmund Asmervik, dott.arch. Houchang Fathi
Institute of Design, Department of Architecture, NTH: prof. Birgit Cold.
The project is financed by The Norwegian Research Council for Science and the Humaneties.

THE STREETS AS A WHOLE

- The street is regarded favourably by most people
- None of the 253 people questioned held a negative view

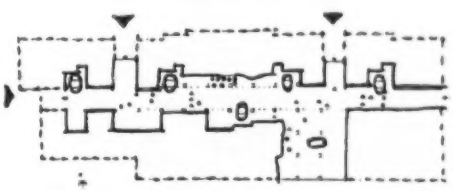
Comments on the street:

- It is very unusual, very bright, friendly and modern, relatively large and quiet, very spacious and open, urban and public, provides variety and feels secure

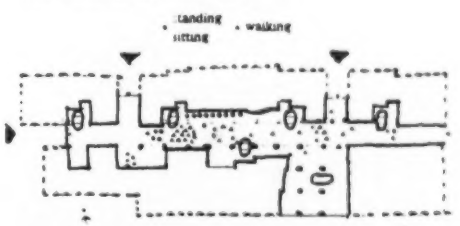


PEOPLE WITH THEIR WORK-SPACE ADJACENT THE STREET

- They consider the street just as positively as do other users
- Sounds from the street and the view are stimulating rather than disturbing
- More than 2/3 consider that daylight and temperature are very satisfactory
- The windows facing the street are opened according to need



09.05 a.m. Shows normal use



11.05 a.m. Shows maximal use

Observations in the street at 9.05 and .1.05 a.m.

OBSERVATIONS

These observatins show the use of the street at 12 different times durng of the day from 9.05 a.m. to 4.10 p.m. The maximum number of people recorded was, at 11.05 a.m. with 60 persons in the street.

On an average there were 25 persons in the street.

The street has a large capacity and gives room for further activities.

Experiences from Dragvoll show that the users notice and appreciate when the glass roof is opened, especially those working in rooms facing the glass-covered street. The glass roof at Dragvoll may be opened 50% and in a way which allows direct visual contact with the sky and the clouds. This construction is contributing to the total feeling of quality. As soon as the temperature in the street rizes to an uncomfortable level, half of the glass roof slides away, and the street opens to the sky.

The view into the offices along the street is individually controlled by curtains, plants and awners.

ACOUSTICS

When glazed spacs is used for communication, for social activities and sporadic, noisy events, it is necessary to use acoustic deadening materials on the indoor facades.

INDOOR CLIMATE

The indoor climate in glazed space and in adjacent rooms is heavily influenced by a number of factors.

But before commenting any of these, it is necessary to emphasize one important condition :
- that windows facing a glazed space should be opened, whenever wanted, and
- that the heating and ventilation system should be designed for this condition.

The indoor climate of the glazed, semi-climatized space should be determined from the planned activities going on all year round or part of the year, from the growing of certain plants, and from the need of experiencing the space as half indoor, half outdoor, with fresh and cool air compared to the 'real' indoor climate.

These considerations may be controversal and difficult to combine all through the year. Many factors influence the indoor climate of the glazed space:

The choice of structures, types of glass, materials, surfaces, sunscreening, orientation of the glazed area, the capasity of opening the glass roof, shadows from the nabouring environment, heat- and ventilation system, and outer conditions as climate, temperature, wind and radiation.

We repeat the necessity of being able to open the glass roof as much as possible when needed. It is not only a question of temperature, but also the psychological effect to experience the direct contact with the outdoor climate, especially on hot days.

The indoor climate and the building factors which influence the climate, should also be considered from the possibility of saving energy. Large surfaces of fully climatized buildings (three floors or more) surrounding the glazed space, provide good possibilities for saving energy. The glazed space may be used as a pre-heater of fresh air needed in the buildings.

PLANTS

Plants and greenery are highly appreciated by the users of glazed space. All year round the green plants give a special character and emphasize glazed space as a climate protected 'in between area'.

The requirements of plants to temperature, caretaking and watering are important when planning surfaces and details. The floor should endure to be washed down and therefore needs grooves. In the Nordic climate, evergreen plants need artificial lighting during the wintertime.

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GLAZED SPACES AND QUALITY

To create quality, many factors and details are already mentioned, but still there are consideration to be made on the level of planning and organizing space which is even more important. Some of these are summarized in the following points:

- Glazed space, as glass covered streets, should be a supplement to urban space and not a competitor. They should not cause the emptying of neighbouring streets, but lead people through districts connecting busy and important streets and squares.

- Public, social and commercial functions should be placed shoulder by shoulder along the glass covered street, and they should all be entered from the covered street.

- Stairs, elevators, halls and other communication areas should be placed along, close to or in the glass covered space. Orientation is easier, and people may 'read' the architecture and find their way. It also brings a lot of life to look at people moving on different floors, and it makes the glazed space a social meeting place.

- The architecture of the glazed space should mediate in choice of materials, details, colours, furnishing, lighting and decoration, that this space is half indoor - half outdoor and half public- half private.

- Arrangements and events, being cultural, artistic, ritual or social, formally planned or informally improvised, should be considered and encouraged.

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